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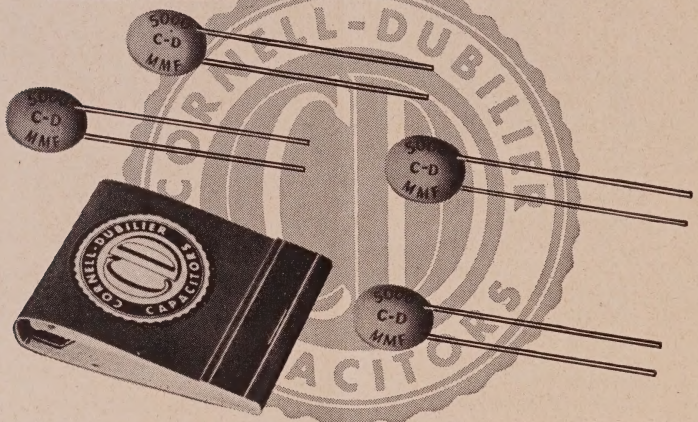

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- High dielectric strength of C-D ceramic, high insulation resistance and low power factor assure constant and dependable service.
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- Presently available in capacities of 50 to 150 mmfd. at ±20% and 500 to 5,000 mmfd, guaranteed minimum capacity over a temperature range of +10°C to +65°C., at 500 V.D.C.W.
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CHECKING CAPACITORS AT RADIO FREQUENCIES

Laboratory-type bridges for checking capacitance and power factor usually are operated at 1000 cycles. The bridge signal is supplied by a self-contained or external audio oscillator having good wave form. Similar bridges designed expressly for radio service use usually are operated at 60 or 120 cycles, since these frequencies may be obtained easily and simply from the power line.

Measurements made at these relatively low frequencies are accepted as standard in a number of instances. However, when the end use of capacitors is in radio-frequency circuits, numerous advantages are obtained by measuring the capacitor characteristics, when possible, at the frequency at which operation is to take place. When instrument limitations make it impossible to make measurements at the actual operating frequency, the closest radio frequency may be employed. A standard frequency of measurement thus is 1000 kilocycles.

Several r. f. methods of checking capacitors currently are in use. This article explains some of these methods. The Editors have included descriptions of schemes employing instruments of various classes, in order to prevent concentration on those precision instruments found only in advanced laboratories.

Q Meter

Most laboratories are equipped with radio-frequency Q meters, and these instruments are invaluable for capacitor measurements. A number of serious-minded servicemen and experimenters have constructed their own Q meters from directions given in magazine articles.

The basic circuit of the Q meter is shown in Figure 1. The r. f. power oscillator, which is the signal voltage source in this instrument, is tuneable from about 50 kc. to 50 or 75 Mc. The adjustable, unmodulated output of the oscillator is coupled into a resonant

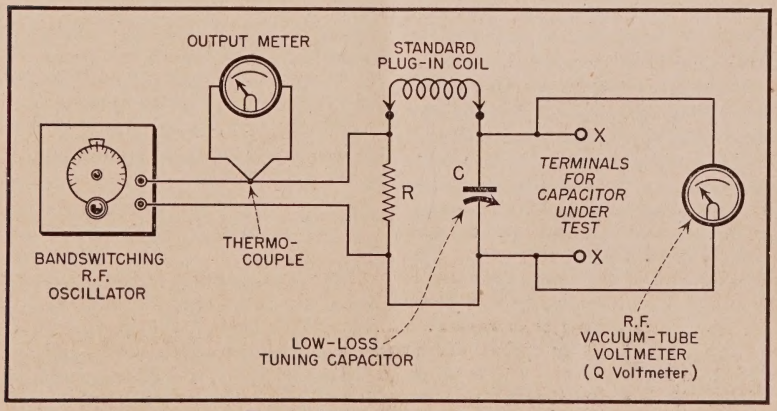

Fig. 1. Basic circuit of Q Meter.

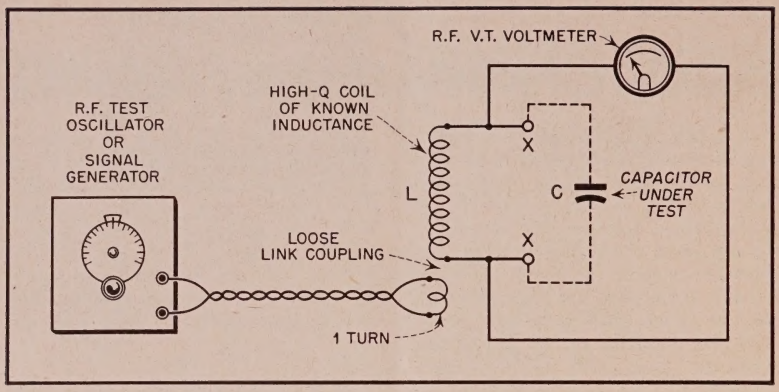

Fig. 2. Experimental setup for C and Q checking.

measuring circuit (consisting of a standard plug-in coil and tuning capacitor C) through non-inductive resistor R which has a value of less than 1 ohm. By means of the thermocouple meter, the operator may set the oscillator output always to a specified reference level. The r. f. vacuum tube voltmeter, usually direct reading in volts and Q units, is connected across the tuning capacitor. Operation of the Q meter is essentially a matter of setting the oscillator to the desired frequency and tuning the measuring circuit to resonance, as indicated by the v. t. voltmeter.

Capacitance Checking. The dial of the tuning capacitor, C, is graduated directly in micromicrofarads. Capacitor C is set at or near its maximum capacitance. The oscillator frequency then is adjusted for exact resonance of the L-C circuit, as indicated by peak deflection of the Q voltmeter. The dial reading of the tuning capacitor is recorded, at this point, as C_1. Next, the capacitor under test is connected to terminals X–X by means of the shortest possible leads. The addition of this extra capacitance detunes the measuring circuit and the Q voltmeter reading accordingly falls. Capacitor C then is retuned in its lower-capacitance direction (this removes the extra capacitance from the circuit) to restore resonance. When resonance is reestablished, the tuning capacitor dial reading is recorded as C_2. The capacitance of the capacitor under test then may be determined by subtracting the second dial reading from the first. That is, $C_x = C_1 - C_2$.

Q Checking. If in addition to recording the C_1 and C_2 settings of the tuning capacitor dial, the oscillator output is held constant, by means of the output meter, and the corresponding peak readings of the Q voltmeter recorded as Q_1 and Q_2, the Q of the capacitor under test can be determined from the equation:

$$(1) \quad Q_x = \frac{C_1 - C_2\,(Q_1\,Q_2)}{C_1\,(Q_1 - Q_2)}$$

The Q graduations of the v. t. voltmeter are based upon the ratio E_1/E_2, where E_1 is the r. f. voltage developed across the tuning capacitor, C, and indicated by the v. t. voltmeter, and E_2 is the r. f. voltage developed across the resistor, R.

Use of R. F. Test Oscillator

When a Q meter is not available, as generally is the case in the radio shop and small laboratory, a signal generator or r. f. test oscillator and r. f. vacuum tube voltmeter may be employed for both capacitance and Q checks of fair accuracy.

Figure 2 shows the apparatus setup. The highest obtainable output of the oscillator or signal generator must be employed. The oscillator output is link-coupled to a high–Q coil of accurately-known inductance L. This coil preferably should be airwound or wound on a low-loss form, such as a length of polystyrene tubing, and should consist of 1 or 2 turns of No. 12 copper wire, 1½ inch in diameter. The coil must be of solid construction. Its inductance must be checked carefully, using a commercial Q meter or inductance bridge. The loosest possible coupling must be employed between the 1-turn link coil and the main coil, L, which will give a good readable deflection of the meter during tests. The r. f. vacuum tube voltmeter must be switched to its lowest range (usually 0–3 volts). The external probe of the v. t. voltmeter must be connected directly to terminal X, in order to avoid the capacitance of long connecting leads.

Capacitance Checking. The "unknown" capacitor, C, is connected to terminals X–X, and the oscillator frequency varied until maximum deflection of the meter occurs, indicating resonance. In order to avoid spurious resonance due to harmonics, the oscillator must be tuned from its lowest frequency upward, and the first resonance point taken. The resonant frequency f is read from the oscillator dial. The unknown capacitance $C = \frac{25{,}400}{f^2L} - C_m$, where C is in microfarads, f in megacycles, and L in microhenries. C_m is the input capacitance of the v. t. voltmeter probe and can be obtained from the meter manufacturer's literature or by means of capacitance measurements made on the probe with a bridge or Q meter.

Q Checking. When the Q of the capacitor is lower than that of the coil, it may be checked by the **susceptance variation method** in the following manner: (1) Connect the capacitor to terminals X–X. (2) Resonate the circuit, as explained in the preceding section, and record the resonant frequency as f_r. (3) De-tune the oscillator to a frequency below resonance at which the meter reading drops to 70.7% of its value at resonance. Record this frequency as f_1. (4) De-tune the oscillator to a frequency higher than resonance at which the meter reading again drops to 70.7% of its value at resonance. Record this frequency as f_2. The circuit Q then may be determined from the calculation,

$$Q = \frac{f_r}{f_2 - f_1}$$

This method has the disadvantage that the Q value obtained is for both the coil and capacitor in combination and is not significant as far as the capacitor is concerned unless the capacitor Q is appreciably lower than that of the coil. This is offset somewhat by keeping the coil Q as high as practicable. The method is entirely useful, however, for comparative indications and is best suited to larger capacitances (that is, those in the range between 0.001 and 0.01 microfarad) which normally give relatively low Q indications.

Radio-Frequency Bridge

Well-shielded, laboratory-type r. f. bridges are available for checking the reactive and resistive components of capacitors, as well as inductors. Construction of an r. f. bridge involves complex design problems and many special fabrication techniques. It therefore should not be attempted by any except well-experienced instrument builders.

When the r. f. bridge is adjusted for null, its dials indicate the reactance and resistance of a capacitor under test. From these readings, capacitance (C) and Q (or power factor) may be calculated. The following relationships show how these calculations may be made:

$$(2) \quad C = \frac{1}{6.28\, f\, X}$$

Where C is the unknown capacitance in microfarads,
f, the bridge frequency in megacycles, and
X, the indicated reactance in ohms

$$(3) \quad Q = \frac{10^{-6}}{6.28\, f\, C\, R}$$

Where f is the bridge frequency in megacycles,
C, the capacitance in microfarads, and
R, the indicated resistance in ohms

Twin-T Null Network

Another useful laboratory-type instrument operated similarly to the bridge by making null adjustments, is the Twin-T Network. The General Radio Type 821-A is an example of this class of instrument.

The Twin-T unit is calibrated in capacitance (C) and conductance (G). Conductance is equal to the reciprocal of resistance; that is, to 1/R. Thus, R = 1/G. From R, C, and f, the Q value of the capacitor under test may be calculated:

$$(4) \quad Q = \frac{1}{6.28\, f\, C\, R}$$

And power factor also may be calculated:

$$(5) \quad \text{p. f.} = \frac{R}{\sqrt{R^2 + (6.28\, f\, C)^2}}$$

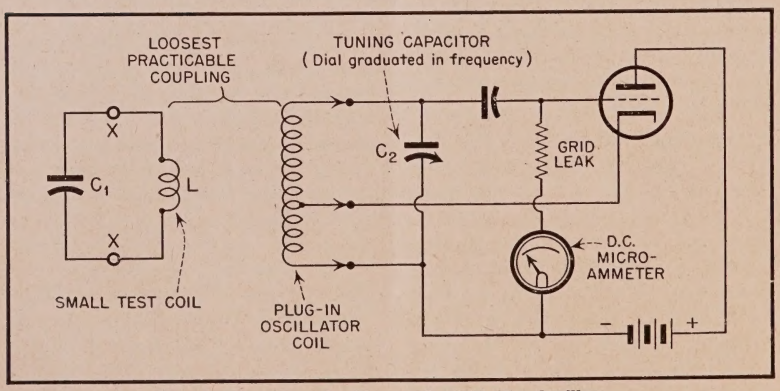

Fig. 3 Capacitor checking with Grid Dip Oscillator.

Use of Grid Dip Oscillator

A large number of amateurs and servicemen lately have added grid dip oscillators to their test equipment. While these instruments are designed primarily for checking the resonant frequency of tuned circuits, they may be employed also for the radio-frequency checking of capacitors.

Figure 3 shows a typical grid dip oscillator loosely-coupled to a capacitor checking circuit. The tuned circuit of the oscillator consists of a plug-in coil and the tuning capacitor C_2. A series of plug-in, or switch-in, coils provide the wide range of frequency characteristic of this instrument. The dial of C_2 is graduated directly in frequency. When an external tuned circuit is coupled to the oscillator coil, and the oscillator then is tuned to the resonant frequency of the external circuit, the latter will absorb enough energy from the oscillator to cause the d. c. microammeter to dip sharply downward. The frequency of the external circuit then may be read directly from the oscillator dial. When the inductance of the coil in the external circuit is known accurately, the external capacitance can be calculated in terms of the coil inductance and oscillator frequency.

The external coil, L, must be solidly constructed and should consist of 1 or 2 turns of No. 12 bare copper wire 1½ inch in diameter, airwound or wound on a length of polystyrene tubing. The inductance of this coil should be measured accurately beforehand with an inductance bridge or Q meter. A pair of binding posts (X–X) must be provided for connecting the unknown capacitor, C_1, to the coil by means of the shortest possible leads.

Capacitance Checking. (1) Connect the unknown capacitor, C_1, to coil L, and place the coil-capacitor combination on an insulating plate or table top clear of all other objects. (2) Couple the oscillator coil to coil L. Use the loosest possible coupling which is found to give a readable meter indication. (3) Tune the oscillator, starting with its lowest frequency and tuning upward. (4) When the resonant frequency of the LC_1 combination is reached, the microammeter in the oscillator grid circuit will dip sharply downward. At this point, read the frequency, f, from the oscillator dial. The unknown capacitance may be calculated:

$$(6) \quad C = \frac{25{,}400}{f^2 L}$$

Where C is in micromicrofarads
f, in megacycles, and
L, in microhenries

Q Checking. The grid dip oscillator cannot easily be used to check **quantitative** values of Q or power factor of capacitors. But it will give useful qualitative indications in the following manner. When the capacitor Q is high, the dip of the microammeter will be sharp and rapid, it being possible to tune completely by the resonant point unless the dial is turned slowly and carefully. When the capacitor Q is low, on the other hand, tuning will be broad, the meter dip becoming slow and shallow.

These comparative indications will be of value in establishing quickly the merits of capacitors under test, although they give no recordable figures.

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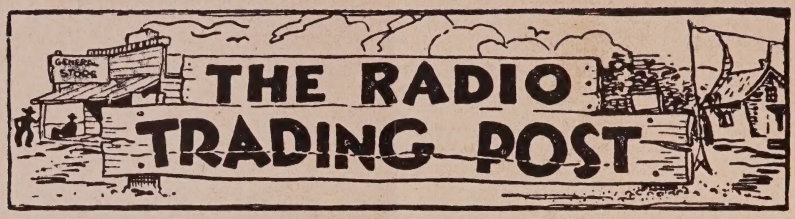

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These columns are open only to those who have a legitimate WANTED, SELL, or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transaction involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

All ads are published in the order received, but those held over two issues are discarded. Every effort will be made to include your ad either in the issue being prepared or the succeeding number, but will be automatically dropped thereafter.

FOR SALE—GED 247 tube tester, $20; Silver Vomax 900, $35; tubes; 2,500 ft. 16mm sound movie film; wire recorder, $50; radio parts. Paul Bernards, Box 32, Bricelyn, Minn.

FOR SALE—Precision V.T.V.M. model EV-10S, good condition, $50. J. J. Johnson, 612 Maple St., Mobile 16, Ala.

FOR SALE—7050 Philco tube checker; vol. 1-16, Riders manuals. Best offer. Radio Service Dep't., Gambles, Pecatonica, Ill.

WANT—Freq. modulator for A.M. and F.M., Sweeps, in good condition. Will trade or sell Vomax 900, Sparx 905, Triplett multitester 625N, Zenith portable. M. Vander Wall, 54 N. Munn Ave., Newark 6, N. J.

FOR SALE—Thordarson 220 v./1600-0-1600 v. at 1.5 amp., $35; 15 Hy. choke, $8, 2 4 Mfd. 3000 v., $4.75 ea., 0-4kv Weston meter, $12. E. P. Sadler, 90 Chippewa Rd., Tuckahoe 7, N. Y.

SELL OR TRADE—Instructograph, 10 tapes, electrically operated; 12 textbooks (RCA Institute). Want good camera or communication receiver. J. Kalenak, 169 Washington Park, Brooklyn 5, N. Y.

SALE OR TRADE—Masco TV booster MTB 13-X, 1940-41 Pontiac auto radio, both in good condition. Make offer or trade. Have other items. N. W. Anderson, 1114 Idaho St., Norman, Okla.

WANTED— BC348, BC221, SCR 522, BC-788, Wilcox CW-3, F-3, ART-13, 50W P. A. system, Super-Pro power supply. Trade Transvision TV 7", all channels, fine operating cond., for BC348 or BC-221. Alfred Livingstone, 12-00 Ellis Ave., Fair Lawn, N. J.

FOR SALE—Riders manual No. 14, $14, No. 16, $6, both good. Ship C.O.D. if I receive $1 for part payment. D. S. Nardo, 434 Straube Ave., Baden, Pa.

FOR SALE—VHF152A, like new, $55. J. Keller, 1533 Liberty St., Trenton 9, N. J.

FOR SALE—G.E. tube tester model TC3A, fully modernized. First $25 takes it; all others returned same day received. J. H. Yeager, 1712 Centre Ave., Reading, Pa.

WANTED—FM antenna suitable for car use with Philco CR-9 AM and FM Pilotuner, must be light, strong, good reception 70-80 miles, easily mounted. F. A. Eldredge, Orchard Rd., Hagerstown, Md.

SELL OR SWAP—Cadillac Custom Built radio, perfect condition, and 2 wall type medicine cabinets for exchange 8" or 10" tilt table saw mach. E. W. Wojcik, 159 N. 6 St., Newark 7, N. J.

WANTED—Used Hallicrafter radio receiver model SX-42, good condition. Will buy or swap for SX-42 receiver. Richard Pearlman, 50 Highland Dr., Willoughby, Ohio

FOR SALE—6 v. Universal Superhet, six tube, 3 band radio, $15; 5" oscilloscope, $30; 5' 6" angle iron relay rack, $4; Gardiner code mach., 10 tapes, Bud audio oscillator, $20. Edward Matthews, 171-35 Courtney Ave., Flushing, N. Y.

SWAP—Complete 7" transvision chassis (needs high voltage power transformer) with enlarging lense; Vibrapack; 2 public address systems; 9 chargers; 'A' eliminator. Need enlarger, art film, etc. S. J. Zuchora, 2748 Meade St., Detroit Mich.

FOR SALE—Complete set Riders and Sams with 1 to 6 Riders used but perfect, the others like new, 22 volumes, $200. New tubes, $552 list, $160; used tubes, etc. A. P. Chapdelaine, 122A N. Quinsigamond Ave., Shrewsbury, Mass.

FOR SALE—Pilot tuner for FM, almost new, $22; BC-312 with xtal, 115 v. power supply, 6AC7 input tube, RA-7 speaker, $55. J. A. Laurent, 2014 E. Genesee St., Syracuse, N. Y.

SELL OR TRADE—TV color filter. 'Telecolor' filter gives glorious color tone, 10", $3, 12", $4. Trade for test equip., receiver, or books. Harvard Lab, 659 Fulton St., Brooklyn 1, N. Y.

FOR SALE—Sig. gen., sig. tracer, tube tester, volt-ohm milammeter, condenser checker, all A-1 cond. 63 Sam's Photo Fact folders, tubes, parts. Everything must be sold together. Wood's Radio Service, Box 75, Jeffersonville, N. Y.

SELL OR SWAP—Radio Eng., Terman, $3; Radio Physics, Ghirardi, $2; TV, Zworykin, $3; FM, Hund, $2; magazines, chemical apparatus, JAN 814 tubes @ $2, etc. Russell McGhee, 122 Schley Ave., Pittsburgh 5, Pa.

SELL OR TRADE—4 SCR-522's, clean condition. Want camera, sweep gen., parts usable in service shop. Inquiries answered. M. S. Ullman, 5425 Conn Ave. NW, Washington 8, D. C.

SELL OR TRADE—Automatic Rolleiflex, 35mm back, plate back, Proxar I, II lenses, Weston master II, Leitz microscope, etc. Want portable typewriter, Zenith overseas portable, etc. Ben Auerbach, Box 5, Phoenix, Ariz.

WANTED—Circuit diagram and/or operating info on W. E. Power Supply M8. KS5900 power unit. Stock No. 6545268. Cont. No. W-271-ORD 4446. Project 59. Reg. 5164. State price. R. E. Morgan, Kocour Co., 4800 S. St. Louis Ave., Chicago 32, Ill.

FOR SALE—Philco model 7070 sig. gen., used little, six bands, from 100 kc.-110 mc., cost $97.50 new. Will trade or ship express collect. First $50 takes it. T. L. O'Neal, 1901 N. N St., Fort Smith, Ark.

SALE OR SWAP—Have load of 6J4's (see C Q March 1949), net price, $8.05, my price, $3.50 or swap for meters. Mel Ellentuch, 1810 Loring Pl., New York 53, N. Y.

SELL OR SWAP—RCA Reviews, vols. 7, 8, 1946-47 and Bell System Tech. Journals, vols. 25, 26, 1946-47. J. W. Meyer, 980 Euclid Ave., Berkeley 8, Calif.

WANTED—Coils for 40 meters for Meissner de luxe sig. shifter. J. P. Andrasko, 223 E. 96 St., New York 28, N. Y.

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SALE OR TRADE—Riders manuals through vol. 14, two yrs. old, perfect cond.; Sams through No. 74; Army tube tester, etc. All good cond. C. T. Reagin, Box 45, Cory, Ind.

FOR SALE—Superior model BR 44 condenser checker, sig. tracer comb., perf. shape, $20 f.o.b. Over 100 used and like new tubes. Need '36 Olds tuning head. Bill's Radio Service, 9937 S. Carpenter, Chicago 43, Ill.

FOR SALE—Synchroscope, 20 tubes, $50; BC-348Q, $60; BC-221AA with cal. book, $60; VFO, band-switching exciter and final, 150 w. power supplies, etc. L. A. Dirks, Route 1, Great Bend, Kan.

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FOR SALE—Complete set up for a beginner at a bargain price, like new, NRI professional sig. tracer, tube tester, tools, etc. Sell complete or separately. Stanley Gilhooly, 11100 Continental Van Dyke, Mich.

FOR SALE—Radio receiver and transmitter BC 1267-A, power supply RA-105-A in rack FM82, wood case, converted to 5" TV receiver, complete with transmitter parts, TM's, etc. Highest bidder F.O.B., 250 lbs. Anthony Bruno, 6105 Algon Ave., Philadelphia 11, Pa.

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SELL OR SWAP—SCR 522 (receiver and xmtr) completely converted, rack mounted. Want VHF 152A or make offer. Answer all letters. W. T. Clark, 880 N. Highland Ave. NE, Atlanta 6, Ga.

SALE OR TRADE—Breting 12 communication receiver, 12" speaker, band spread 10 meters, three broadcast band, good cond. Make offer (no radio equip.) M. Shively, 3115 Ingham St., Lansing 10, Mich.

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FOR SALE—Triplett sig. gen., mdl. 3432; Simpson 260 multimeter; RME 84 receiver 6V6-PR807 40 meter CW transmitter, 2 power supplies. Make offer. Kenneth Ballard, Mason City, Ill.

SALE OR EXCHANGE—5 console cabinets, F.O.B., 2 electric motors, Oliver typewriter, wall case, Maine hunting lodge, 15' aluminum trailer. M. Mendel, 2903 Mulberry St., Pittsburgh 1, Pa.

FOR SALE—Daul speed phono-recorder, 12" speaker in cover, 5" speaker in assembly, permits actual monitoring of recorded record. $90 or offer?. Modern Recording Co., 77 Church St., Wilkes-Barre, Pa.

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FOR SALE—C-F Solar exameter, Hallicrafters radio receiver S 20R, Gardiner automatic tape sender, model S, Bud CPO code practice oscillator. John Anderson, 514 S. Park St., Elizabeth, N. J.

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FOR SALE—Plate camera, 16mm movie camera, Marton slide projector, studio and movie lights, flash gun, Federal disc recorder, 2 phono motors, etc. Samuel Harelick, 27 E. 39 St., Bayonne, N. J.

WANTED—Back issues of Electronics magazines: January to May, 1945, also April and May, 1948. C. Masciarelli, 565 Main St., Clinton, Mass.

FOR SALE—Model 450 Superior tube tester, $30; Radio City sig. gen., model 702, $25. Both good cond. C. A. Johnson, 114 E. Upright Ave., Charlevoix, Mich.

TRADE—Set numbers 26, 41, 42, 48 Howard Sam's for any sets above No. 70. S. T. Smith, 90 Summit St., Manchester, Conn.

WANTED—Stamps, foreign or U. S., or collection including album. Trade 100-1000 kc. xtal calibrator or electronic equipment. You name it. No junk either way. Bob Eubank, 1227 Windsor Ave., Richmond 27, Va.

WANTED—BC221 or LM-type frequency meter and blank calibration books for these meters. Cash. Tell cond., lowest price. Have ham band crystals, $1.50 per. L. W. Johnson, RD 1, Drums, Pa.

SWAP—Hickok Jumbo VOM, Carron sig. gen., 15 x 50 binoculars with tripods, other accessories. Triplett all wave servicer. Want test equip., amplifiers, etc. Write. Charles Roberts, 2637 Liberty Rd., Muskegon, Mich.

FOR SALE—Magnerotor-TV antenna motor, wire, and control box, used 4 weeks, up to 1¼" mast, $12. 16mm double frame still camera, 3.5 lens, $10. Robert Flory, 715 E. Buffalo St., Ithaca, N. Y.

SELL OR TRADE—Riders, servicing superhets, A.V.C. V.T.V.M., power plant course, books, bargains. Super Radio Service, 58 Carey Ave., Wilkes-Barre, Pa.

FOR SALE—Vision tele-booster model TVX, $15; Buick 1937 model 980534 car radio, overhauled, good cond., $15. H. D. Westbrooks, Box 281, Griffin, Ga.

SALE OR SWAP—McMurdo Silver VOMAX model 900, perfect cond. Want Tenna Rotor with indicator HF 10-20 or VHF-152-A, good cond. Make offer. Ernest Tucker,, c/o Radio Station WEKR, Fayetteville, Tenn.

TRADE — Meisser radio-recorder in A-1 cond. for signal tracer, condenser tester, or sig. gen. Make offer. Parson's Radio Service, Box 152 Fullerton, Ky.

SELL OR SWAP—Feiler TS-7 scope, like new; Springfield, Enfield rifles. Need V.T.V.M., volometer, cap. analyzer, etc. Johnson, 2504 N. Estrella, Tucson, Ariz.

TRADE OR SELL—Twin-Trax recording chassis, Corona typewriter, Webster record player model 56 with amplifier, cabinet. Want battery eliminator, Hickok TV gen., model 610A, etc. Luther Cansler, Kings Mountain, N. C.

FOR SALE—Used radio parts, low prices; RCA model 167-B sig. gen., $30; Superior utility tester, 4" meter, like new, $10. Answer inquiries. Capp's Radio Service, 301 N. Market St., Mechanicsburg, Pa.

SELL OR SWAP—NC 46 rec., excellent cond., used little, $65; Weston meter 665 type 2, Espey model 104 multitester, $10; Superior multitester 1280, rewired, $15, or trade all for Hickok 288X. Jim Welson, 213½ E. Market St., Tiffin, Ohio

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SELL OR SWAP—NRI radio, TV courses, whole or parts, bought and sold. Glen Par, 1612 Summer St., Philadelphia 3, Pa.

FOR SALE—C.R.E.I. TV course, in good cond., $50. J. P. Claybourne, 48 Avenel St., Avenel, N. J.

WANTED—Emission type tube tester in good cond. Ralph Bailek, 1521 S. Drake Ave., Chicago 23, Ill.

FOR SALE—Superior tube, set tester, model 1280, good cond, $12. M. Francis, 1232 E. 75 St., Chicago 19, Ill.

WANTED—Riders manual, vol. 9. Will pay cash. State condition and price. S. R. Landis, 602 Schuylkill Ave., Reading, Pa.

TRADE—Radio News, 1929 through 1933, and Radio Craft, 1930 through 1936; RCA portable sig. gen., BC221N. Want DB22-A, VHF152A, Gonset 3-30. Write for list. L. W. Holmes, 714 Maple St., Brainerd, Minn.

WANTED—Riders manuals, individual or complete set. State condition, price. J. O. Basham, Altamont, Covington, Va.

SALE OR TRADE—Webster 60 and model 55 record changer amplifier. Best offer. Goodman's Radio, 717 S. 52 St., Philadelphia, Pa.

SWAP—Unique Universal II slide rule, for any two Riders manuals, except vol. 1, 2, 3, and 4. C. E. Propst, Box 106, Mona, W. Va.

SALE OR TRADE—Mark II transceiver, complete with spare parts, tubes, never used. Trade for test equipment. Oliver Pinkerton, 376 E. Ohio Ave., Sebring, Ohio

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FOR SALE—Electronics magazines, good cond., every issue of 1942, 1943, January through April, 1944, May through Dec. Make offer. Want Riders 1, 3-6, 13, good cond. Melvin Kilhefner, 270 Duke St., Ephrata, Pa.

WANTED—Candometer resistance indicator; IRC resistance analyzer and indicator; Solar condenser quick checker, model BQC. G. E. Eggleston, Box 524, Geneva, Minn.

WANTED—Several APN 9 Loran or equivalent, BC221 frequency meters, BC224 or BC1060-B oscilliscopes. State cond., completeness, price. R. L. Shahan, 2429 S. W. 172 Seattle 66, Wash.

SALE OR SWAP—For radio equipment, tubes, etc. like new copies of Popular Mechanics, Popular Science, Mechanics Illustrated, etc. Write Dick Miller, 1934 E. Broadway, Muskegon, Mich.

FOR SALE—2 Weller model B speed irons, Electron 6 v. junior battery charger, sig. gen., FADA TV model 799, Philco M-15 L. P. record player. Offer? Joe's Radio Service, Berrysburg, Pa.

FOR SALE—Heathkit oscilloscope, already wired and operating, $25. R. L. Ingram, 4 W. Dover St., Easton, Md.

FOR SALE—Vols. 8 to 14, Riders manuals, nearly new. Ernest Bonem, 1110 Egan Ct., Cincinnati 29, Ohio

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SALE OR TRADE—1949 Sprayberry Academy of Radio course, all text books and lessons with answers, very good cond. Want radio parts or test equip. C. E. Brown, P.O. Box 242, La Frank, W. Va.

WANTED—Silvertone radio chassis, model 1781 or 1781A. Will pay cash. Radio Service, P.O. Box 595, Passaic, N. J.

FOR SALE — Precision EV-10 V.T.V.M., model 33 sig. tracer; Philco sig. gen., vol. 1, 1 binder, sets 39-80 of Sam's Photofacts, Riders vol. 11, car aerial, $200 f.o.b., or sell separately. R. E. Pratt, South New Berlin, N. Y.

FOR SALE—DeForest's radio, TV course, 1947 edition, $10; Feiler sig. tracing stethoscope, model TS-3, $30. H. J. Richards, 6716 S. Parnell Ave., Chicago 21, Ill.

FOR SALE—Abbott TR-4 transmitter-receiver, also power supply for same. Hallicrafters S19-R, Hallicrafters S-20, Newsig. tracer. W. H. Lorimer, 432 Sheridan St., Williamsport, Pa.

WANTED—NRI correspondence course in communication, answers. Want equip. and testers or what have you? State best price. Want code practice records, 78 r.p.m. R. Fazenbaker, P.O. Box 654, Langley Air Force Base, Hampton, Va.

TRADE—Practically new model 80 Webster wire recorder for model SX-42 Hallicrafters receiver. D. L. Smith, P.O. Box 191, Leaksville, N. C.

WANTED—Hallicrafters S-38, good cond. Send description, age, etc. Harold Buchert, Box 76, Piketon, Ohio

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FOR SALE—Stephens P-15 high freq. unit and 814H horn, 800X crossover network, 103LX 15" low freq. speaker. Jensen 18" dynamic speakers. UTC LS-33 line transformer. Donald Keiser, Gladbrook, Iowa

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SALE OR TRADE—Pilot FM tuner, used a few hours. Need drill, tools, testing equipment or any items useful to radio servicing. Make offer. J. G. Kelly, 70 Superior Rd., Bellerose, L. I., N. Y.

FOR SALE—Like new vol. 1-7 Supreme diagram manuals, $10. E. A. Gruneich, Buffalo, N. Dak.

FOR SALE—Like new Army Signal Corps BC-946-B broadcast receiver with converter for 115 v. operation, P.M. speaker in steel cabinet, $15. M. Oberholtzer, Box 165, Mifflin, Pa.

SALE OR TRADE—Weston 772 VOM; Riders manuals 1, 4, 6; Howard 430 communication type receiver; Thor Binks model 17 professional spray gun. Glenn Watt, 415 W. First St., Chanute, Kan.

SWAP—DeForest radio, TV course complete with kits for late model receiver in good cond. H. M. Denison, 21 S. 4th St., Columbia, Pa.

FOR SALE—Cathode ray tube at work, automatic volume control, resonance and alignment, radio questions, answers, all by Rider; Elect. calculations by Sloane; vols. by Burns, Havelock, $5. R. Turner, 9 Lawrence Rd., Medford, Mass.

FOR SALE—300 w. PP 35 T's fone/CW transmitter. 80 thru 10 meters, band-switching exciter, $350. Bob Friebertshauser, 523 National Rd., Wheeling, W. Va.

FOR SALE—Portable Zenith radio, model No. 66001, plays on 117 v. A.C.-D.C. and battery. Minus battery. Make offer. Lionel Fiquet, 339 19 St., Brooklyn, N. Y.

SALE OR SWAP—Leeds-Northrup, type S resistance testing bridge; Rider chanalyst, built-in loudspeaker. Want Savage Hi-Power repeating lever action rifle, model 99-EG, cal. .250/3000. C. S. Brotzman, 173 Main St., Mexico, Me.

FOR SALE—Precision Series 912P tube tester, walnut case, $40; Precision Series E200 sig. gen., metal case, $40; Riders manuals, 1-16, $160. Robert Hohenberger, 169-19 24 Rd., Flushing, N. Y.

FOR SALE—Modern radio shop, $1500 inventory at cost. Also used radios, tubes, Sam's Photofacts in cabinet. Vince Electric Shop, Carterville, Ill.

FOR SALE—Directory of radio, TV magazines; name, address of 29 with date established; subscription, current single copy prices, 25c. J. T. Cookson, Lock Box OCD, Puxico, Mo.

WANT—RCA model 9T or 9K2 receiver, chassis only without tubes. J. H. Schultz, 402 W. N. Grand, Springfield, Ill.

FOR SALE—Sig. gen. by Approved Electronic, model A200, $25; radio tubes, also 25A7, 25C6, 25B5, $4. Austin Radio Service, 809 N. Austin Blvd., Chicago 51, Ill.

FOR SALE — Complete station working $250, HQ129X with spkr., Meissner ex. mod., Meissner NBFM unit, Triplett H666 tester, Mike JT30, Amphenol antenna, xtls wavemeter, etc. N. K. Stover, 1357 Hill St., York, Pa.

FOR SALE—Speco sig. tracer, model STAC and 5 tubes, $20; Philco radio, 9 tubes, model 91 series; Stewart Warner, model 1845, 10 tubes; train transformers. R. J. Hanson, 2820 E. 122 St., Cleveland, Ohio

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FOR SALE—78 r.p.m. General instrument record changer, walnut finish cabinet, $15; 2-speed General Indust. recorder-player, 12 w. amplifier, assembled, excell. cond., $45, express collect. Tuck Radio Service, Point of Rocks, Md.

FOR SALE—Rider manuals, vols. 1-12 in perfect cond., will not separate, $60, f.o.b. H. J. Carr, 125 Walnut Ave., Croydon, Pa.

FOR SALE—SX-28 receiver, $125; Sonar XE-10 NBFM exciter, $16; 10 meter, 3element Workshop beam, $35; 16" dual speed R EK-OCut transcription turntable, $50 Par Metal cabinet, $18. Willis Connor, 214 Vine Ave., Park Ridge, Ill.

TRADE—Like new DRC 415 Isolation transformer for good used 5 or 6 tube small radio. Mike's Radio Repair, 3610 6 Ave., Des Moines 13, Iowa

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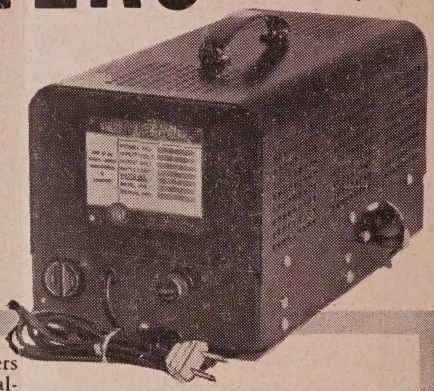

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